

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:

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**PCT**

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing  
(day/month/year)

20 -05- 2005

Applicant's or agent's file reference  LM 11971 WO	<b>FOR FURTHER ACTION</b> See paragraph 2 below	
International application No. PCT/SE 2004/001810	International filing date (day/month/year) 03.12.2004	Priority date (day/month/year) 05.12.2003
International Patent Classification (IPC) or both national classification and IPC C23C 14/08, C23C 14/56, C23C 30/00, H01L 31/02, H01M 6/00		
Applicant SANDVIK AB (publ) et al		

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later. For further opinions, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE  
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International application No.

PCT/SE 2004/001810

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

This opinion has been established on the basis of a translation from the original language into the following language, \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

a sequence listing  
 table(s) related to the sequence listing

b. format of material

in written format  
 in computer readable form

c. time of filing/furnishing

contained in the international application as filed.  
 filed together with the international application in computer readable form.  
 furnished subsequently to this Authority for the purposes of search.

3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>3, 8, 12-13</u>	YES
	Claims	<u>1-2, 4-7, 9-11, 14-15</u>	NO
Inventive step (IS)	Claims		YES
	Claims	<u>1-15</u>	NO
Industrial applicability (IA)	Claims	<u>1-15</u>	YES
	Claims		NO

## 2. Citations and explanations:

Reference is made to the following documents:

- D1-a) Patent abstracts of Japan, abstract of JP-60 149 778-A, publ. 1985-12-12
- D1-b) Derwent's abstract of JP-060 149 778-A, week 198538
- D2) WO 03/48402-A1
- D3) EP-416 887-A2
- D4) US-4 519 339-A
- D5) Derwent's abstract of JP-06 315 641-A, week 199505
- D6) US-3 920 583-A
- D7) Patent abstracts of Japan, abstract of JP-4 193 968-A, publ. 1992-10-26
- D8) US-5 510 008-A

The present invention relates to a stainless steel strip product, especially a ferritic chromium steel strip, which is coated with zirconia, preferably YSZ. It also relates to a substrate material for production of flexible thin film products, such as flexible Cu(In,Ga)Se<sub>2</sub> (CIGS) solar cells and solid state thin film batteries.

One aim of the invention is to avoid earlier problems in the form of bad adhesion between coating and substrate due to cracks and pinholes formed during the heating steps. This is achieved by a product with a thermal expansion that matches the strip steel material. Furthermore, the method for producing the strip shall be inexpensive and possible to

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

produce in a continuous ("roll-to-roll") process.

D1-a, b (the abstracts) reveals a steel sheet (i.e. a kind of "strip"). It is coated with zirconium oxide or stabilised zirconium oxide. The thermal expansion coefficient of the coating is about the same as that of the steel sheet substrate. The coating is evaporated on the substrate and a strong adhesion between coating and steel sheet arises.

D2 (p.4, line 21-p.7, line 23, p.44, lines 8-18, claims 25, 27 and abstract) reveals a product, such as a ferritic stainless steel strip, which is in contact with YSZ. The coefficient of thermal expansion of the ferritic stainless steel is within 25 % of that for YSZ and provides a good thermal expansion match with the YSZ. The product can be used in, for example, solid oxide fuel cells and other products for electrical power generation.

D3 (p.2, line 52-p.3, line 14 and p.3, line 55-p.6, line 41) reveals a process for continuously coating of layers on ribbon-shaped stainless steel substrates, such as ferrite-type stainless steel substrates. The layers consist of, for example ceramic layers, such as  $ZrO_2$ . PVD is a useful coating method.

D4 (col.1, line 60-col.4, line 28 and fig.1, 2, 6) describes a continuous production of solar cells. A web of, for example, stainless steel, is coated with layers. Zirconia can be one of them.

Claims 1- 2, 15

D1-D3 describe coated stainless steel products according to present claim 1. Hence, the invention in claim 1 is not novel.

The product in claim 2 does not differ from what is known in D1. Hence, the subject matter of claim 2 lacks novelty. In addition, it should be pointed out that it is well known to

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Supplemental Box

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Continuation of: BOX V

a person skilled in the art that thermal expansion mismatch between substrate and coating give rise to problems with bad adhesion between substrate and coating as well as formation of cracks in the coating, refer to, for example, D8 (col.2, lines 17-56)). Applying this knowledge to coated steel strips, such as those coated with zirconia, is considered obvious for a person skilled in the art.

In D4 the product is used in a continuous production of solar cells. Even though other layers than zirconia are deposited on the web, the web product is present in some phase of the production. Therefore, the substrate material is not novel in connection with the production of solar cells. Hence, the subject matter of claims 1 and 15 lacks novelty with respect to D4.

The invention differs from D2 in that the stainless steel strip is coated with the zirconia, specifically. This does not seem to give rise to any surprising technical effect when using the product. With the knowledge of D2, a person skilled in the art is faced with the problem of finding an alternative product, which is suitable for using in solid oxide fuel cells and other products for electrical power generation. As coating steel strips with zirconia is a well known process for a person skilled in the art, he would use this knowledge and arrive at a product according to claim 1. In addition, as it is well known that matching thermal expansion coefficients give rise to good adhesion between coating and substrate (no exfoliation) and low crack formation, cf. D1 and D8 (col.2, lines 17-56), it is considered obvious for a person skilled in the art that the coating does not form cracks and scale off. Therefore, with respect to D2, the subject matter of claims 1 and 15 is not considered to involve an inventive step.

Claims 3-14

Most of the features stated in the characterising parts of claims 3-14 are known from D1-D7. The others are embodiments, which are considered obvious for a person skilled in the art.

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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of: **BOX V**

Further documents of particular relevance

In further view of D5 (abstract), D6 (col.1, lines 1-32 and col.3, lines 34-40) and D7 (abstract), the invention according to claims 1-14 is not considered to define an invention that fulfills the requirements of novelty and inventive step.

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International application No.  
PCT/SE 2004/001810

Box No. VI Certain documents cited

1. Certain published documents (Rules 43bis.1 and 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
WO 2005/15645 A1, E	17.02.2005	09.08.2004	12.08.2003

2. Non-written disclosures (Rules 43bis.1 and 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)